Bifurcation scenario to Nikolaevskii turbulence(New Development of Dynamical Systems with Topological and Computational Methods)

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Nikolaevskiiカオスへ至る分岐シナリオ
Bifurcation scenario to Nikolaevskii turbulence

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We show that Turing instability can lead oscillatory reaction-diffusion (RD) systems to spatiotemporal chaos instead of spatially periodic steady states. Similar onset of chaos was discovered in an equation that describes seismic waves (called Nikolaevskii turbulence) and observed experimentally in convective systems (called soft-mode turbulence).

We demonstrate that a certain class of oscillatory RD systems are reduced to an extended complex Ginzburg-Landau equation, whose uniformly oscillating solution possesses not

only Benjamin-Feir criticality but Turing criticality [1]. In the neighborhood of a codimension-two point of these criticality, we derive a phase equation equivalent to the seismic equation [2]. We also present numerical studies of reduced equations and a three-component RD model in this regime [2][3][6]. The numerical results support our argument and show robustness of this type of spatiotemporal chaos [6]. Finally, we derive critical exponents of chaotic fluctuations and study bifurcation scenario to this chaos [4][5].

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